



TENNESSEE DEPARTMENT OF

EDUCATION
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Introduction to Electromechanical

Primary Career Cluster:	Manufacturing
Consultant:	Bethany King Wilkes, (615) 532-2844, Bethany.Wilkes@tn.gov
Course Code(s):	6091
Prerequisite(s):	Principles of Manufacturing (5922), Algebra I (6109/3102), and Physical Science (3202). <i>Note: Algebra I (6109/3102) and Physical Science (3202) may be taken as co-requisites.</i>
Credit:	1
Grade Level:	10
Graduation Requirements:	This course satisfies one of three credits required for an elective focus when taken in conjunction with other Manufacturing courses.
Programs of Study and Sequence:	This is the second course in the <i>Electromechanical Technology</i> program of study.
Necessary Equipment:	Refer to Teacher Resources page below.
Aligned Student Organization(s):	SkillsUSA: http://www.tnskillsusa.com Brandon Hudson, (615) 532-2804, Brandon.Hudson@tn.gov Technology Student Association (TSA): http://www.tntsa.org Amanda Hodges, (615) 532-6270, Amanda.Hodges@tn.gov
Coordinating Work-Based Learning:	If a teacher has completed work-based learning training, he or she can offer appropriate placement. To learn more, please visit http://www.tn.gov/education/cte/wb .
Available Student Industry Certifications:	None
Dual Credit or Dual Enrollment Opportunities:	There are no statewide dual credit/dual enrollment opportunities for this course. If interested in establishing a local opportunity, reach out to your local postsecondary institution.
Teacher Endorsement(s):	531, 584, 596
Required Teacher Certifications/Training:	None
Teacher Resources:	http://www.tn.gov/education/cte/Manufacturing.shtml

Course Description

Introduction to Electromechanical is a foundational course that introduces students to basic electromechanical skills necessary in a manufacturing facility. Topics covered include safety,

construction drawings, site layout, hand and power tools, linear and angular measurements, and application of algebraic and geometric principles to construction problems. Standards in this course are aligned with Tennessee Common Core State Standards in English Language Arts & Literacy in Technical Subjects and Tennessee Common Core State Standards in Mathematics.*

Program of Study Application

This course is the second course in the *Electromechanical Technology* program of study. For more information on the benefits and requirements of implementing this program in full, please see the program of study description documents found on the Manufacturing website at <http://www.tn.gov/education/cte/Manufacturing.shtml>.

Course Standards

Safety

- 1) Assess a given situation requiring the use of tools, equipment, and materials. Explain the applicability of various safety standards and procedures, and then safely demonstrate the use of the tools, equipment, and materials. For example, the hoisting of material requires lifting equipment of sufficient strength and applicability to the task, physical clearance from personnel, necessary alerting to others, and authorization to use the required equipment, as well as conformance to Occupational Safety and Health Administration (OSHA) policies for avoiding and reporting accidents associated with this type of activity. (TN CCSS Reading 2, 3)
- 2) Assess a given situation requiring the use of hand and/or power tools. Select the proper tool and accessories, critique the readiness of the tool, use the tool to accomplish the desired task, and then return the tool and accessories to its proper storage. For example, creating a hole in aluminum requires the choice of the proper drill, drill bit, mounting hardware, lubricant, and safety procedures and precautions. The suitability of the drill bit is just one of many aspects that must be assessed and analyzed. (TN CCSS Reading 3)
- 3) Analyze situations, create plans, and implement plans requiring the use of rigging to install and/or remove equipment and machinery. Perceive and critique the safety risks involved in the job. For example, contrast the implications of lifting and positioning heavy objects of small compact shape versus those of large rotational moment. (TN CCSS Reading 3, 4; TN CCSS Writing 4)
- 4) Identify and evaluate situations that require electrical circuits and electromechanical principles. Develop and safely implement a plan to achieve the desired electromechanical objective. For example, recognize the power requirements for operating a 35 hp lathe, develop a wiring plan, and draft the details for a work order. (TN CCSS Reading 4)

Problem Solving & Critical Thinking

- 5) Create linear and angular drawings to represent real-world physical scenarios in two and three dimensions. For example, based on physical requirements for a bracket, develop a plan, and create a drawing based on the required geometry for accurately fabricating the bracket, including precise linear and angular measures. (TN CCSS Reading 7; TN CCSS Math: N-Q, A-CED, G-GMD, G-MG)



- 6) Apply mathematics concepts to solve electronics and manufacturing industry problems. For example, calculate the impact of the addition of random variables representing material dimensions that include several tolerances and dimensional allowances on the final combined work product. (TN CCSS Reading 4, 7; TN CCSS Math: N-Q, A-SSE, A-REI)
- 7) Create two- and three-dimensional scale drawings using accepted dimensioning rules and measurement systems. For example, as part of a project to fabricate a custom-shaped metal block, develop the complete drawings that specify the dimensional details for each step of the construction process. (TN CCSS Reading 3, 7; TN CCSS Math: A-REI, G-CO, G-C, G-GMD, G-MG)
- 8) Identify and demonstrate basic troubleshooting strategies appropriate for evaluating electronic circuits/systems and electromechanical devices. For example, in a relay-logic circuit with four display bulbs, develop and implement a troubleshooting strategy to remedy a bulb that fails to light. (TN CCSS Reading 3; TN CCSS Math N-Q, S-IC)

Computers & Electronics

- 9) Demonstrate understanding of the operation of electrical circuits and devices and relate it to the physical laws (such as Ohm's Law, Kirchhoff's Law, and power laws) that govern the behavior of electrical circuits and devices. Accurately apply these physical laws to solve problems. For example, calculate and support the consequence of the maximum volume of air that can be moved by an AC-powered 50 hp electric motor. (TN CCSS Reading 3, 4; TN CCSS Math N-Q, A-CED, A-REI, F-BF)
- 10) Explain the interrelationships among sources of current, voltage, resistance, and power in electric circuits, both theoretical (illustrated) and actual by designing a direct current (DC) circuit of resistors and LEDs, and predicting the likely current and power requirement. Discriminate among used resistors in a junk box, using the color codes to identify resistors of suitable value. (TN CCSS Reading 1, 5; TN CCSS Writing 4; TN CCSS Math N-Q, A-REI)
- 11) Assemble the required connections of electronic test equipment to properly test the operation of basic electronic circuit behavior and performance, using equipment such as a digital multimeter, oscilloscope, and resistance bridge. For example, design, assemble, and verify a passive analog filter able to block at least 6 dB of audio-level signals of frequency greater than 500 Hz. (TN CCSS Reading 3; TN CCSS Math N-Q)

Production & Processing

- 12) Investigate an assortment of occupations and manufacturing processes that rely on electromechanical principles and technologies, such as shipyard rigging, metalworking, agricultural mechanics, construction, and medical prosthetics. Write an informative text that summarizes the typical educational and certification requirements, working environments, and career opportunities for these occupations. (TN CCSS Reading 2; TN CCSS Writing 2)
- 13) Analyze and describe a variety of quality control constraints on manufacturing materials, parts, and processes that impact the suitability of a given electromechanical production process. Collect and interpret data that includes, but is not limited to, physical and electrochemical properties such as size, mass, hardness, pH, temperature, conductivity, rate, and so forth, and



synthesize the results to yield a clear, written documentation of the findings. For example, assist a quality assurance inspector who must carefully complete the steps of a standard inspection order to certify an incoming shipment of raw material by making several measurements and tests for conformance to specification. (TN CCSS Reading 1, 5; TN CCSS Writing 7)

- 14) Inspect and interpret blueprints, schematic diagrams, or written specifications for electromechanical devices and systems. Explain how pictorial representations relate to an actual project layout, verifying sufficient agreement as prescribed by specified tolerances. For example, create a proposed parts list for wiring a room addition based on electrical construction drawings, conforming to generally accepted building codes. (TN CCSS Reading 1, 5; TN CCSS Writing 7; TN CCSS Math N-Q, G-CO, G-GMD)
- 15) Given a malfunctioning electromechanical system, use resources such as blueprints, diagrams, and equipment manuals to troubleshoot the machinery. Develop and graphically illustrate at least three possible solutions to the problem. Select the optimal solution and justify the selection with evidence drawn from the resources listed above. (TN CCSS Reading 1, 4; TN CCSS Writing 1, 4)

Standards Alignment Notes

*References to other standards include:

- TN CCSS Reading: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Reading Standards for Literacy in Science and Technical Subjects 6-12; Grades 9-10 Students (page 62).
 - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 6, 8, 9, and 10 at the conclusion of the course.
- TN CCSS Writing: [Tennessee Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects](#); Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects 6-12; Grades 9-10 Students (pages 64-66).
 - Note: While not directly aligned to one specific standard, students who are engaging in activities outlined above should be able to also demonstrate fluency in Standards 3, 5, 6, 8, 9, and 10 at the conclusion of the course.
- TN CCSS Math: [Tennessee Common Core State Standards for Mathematics](#); Math Standards for High School: Number and Quantity, Algebra, Functions, Geometry, Statistics and Probability (pages 58-83).
 - Note: The standards in this course are not meant to teach mathematical concepts. However, the concepts referenced above may provide teachers with opportunities to collaborate with mathematics educators to design project based activities or collaborate on lesson planning. Students who are engaging in activities listed above should be able to demonstrate quantitative, algebraic, functional, geometric, and statistical reasoning as applied to specific technical concepts. In addition, upon completion of this course, students will have the opportunity to practice the habits of mind as described in the eight Standards for Mathematical Practice.



- P21: Partnership for 21st Century Skills [Framework for 21st Century Learning](#)
 - Note: While not all standards are specifically aligned, teachers will find the framework helpful for setting expectations for student behavior in their classroom and practicing specific career readiness skills.

